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ON

CALCULOUS DISEASE,

AND

ITS CONSEQUENCES

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ON

CALCULOUS DISEASE

AND

ITS CONSEQUENCES:

BEING

THE CROONIAN LECTURES FOR THE YEAR 1856,

Delibered before the Royal College of Physicians,

BY

George OWEN REES, M.D. F.R.S., &c. &c.
FELLOW OF THE COLLEGE;
ASSISTANT PHYSICIAN AND LECTURER AT GUY'S HOSPITAL;
EXAMINER ON MATERIA MEDICA IN THE UNIVERSITY OF LONDON.

LONDON:
LONGMAN, BROWN, GREEN, AND LONGMANS.
1856.

PREFACE.

The President of the Royal College of Physicians having done me the honour to appoint me Croonian Lecturer for the year 1856, I take this opportunity of publishing the Lectures delivered before the College in that capacity.

While preparing the manuscript for the press, some trifling alterations and additions have been made; but in doing this my original intention of regarding the subject in its practical bearings has been carefully adhered to. The contents are divided into three chapters, which, more or less, correspond with the three Croonian Lectures. The chemical history of calculous disease has been noticed only so far as the pathology of the subject absolutely requires. The observations relating to the formation of calculi have, I believe, some claim to novelty, while they possess

an important bearing on therapeutics. The precautions necessary, in order to form a correct diagnosis between certain calculous diseases and those affections which nearly simulate them, have received especial attention in the following pages; and I would beg to refer the *medical* as well as the surgical reader, when studying this important part of the subject, to the work of Sir Benjamin Brodie on Urinary Diseases.

Albemarle Street,
May, 1856.

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CALCULOUS DISEASE,

AND

ITS CONSEQUENCES.

CHAPTER I.

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As a preliminary step, and as one of the principal objects I have had in view in treating of calculous diseases, I shall first proceed to show that we ought to place in the same category two forms of the affection which have been hitherto considered as differing essentially from each other; while I hope

to prove that a third form, of frequent occurrence in practice, and a source of much anxiety, must be regarded merely as a sequel of other conditions, more or less connected with lithiasis.

This view, which I believe will tend greatly to simplify the study of the subject, I would apply to the consideration of the uric acid diathesis, in its relation to the oxalic; while I think I can adduce sufficient evidence to prove that the so-called phosphatic diathesis, as observed in calculous disease, is nothing else than a sequel of other conditions, and that it results from mechanical or chemical irritation produced in the urinary channels.

The close relation between the oxalic and uric diatheses has been frequently noticed by chemists, and formulæ invented showing the facility with which the elements of uric acid may be converted into those of oxalic acid and urea by the addition of water and oxygen. It has also been long known that the urate of ammonia contained in specimens of guano, frequently becomes entirely converted into oxalate of ammonia during the voyage home; so that there is but little difficulty in believing that oxalate of ammonia may thus form in human urine when urate of ammonia is in excess, and that by decomposition of the calcareous salts present, oxalate of lime may form.

The question, however, must arise as to the locality in which this change is effected; whether,

that is to say, oxalic acid and its compounds be produced from uric acid or from the urates *in the blood;* or whether, on the other hand, the change be effected in the urine after secretion by the kidney. In this latter case, the *uric acid* in combination will be excreted as such into the urine, but by after processes, occurring either in the urinary passages, bladder, or chamber vessels, it will present itself to the medical attendant converted (as in guano) into a compound of the oxalic acid. If this be really the case, then we are, of course, constrained to admit that the state of system in which we observe a tendency to the formation of oxalate of lime in the urine, must be considered identical with that accompanying the uric acid diathesis, and as requiring the same treatment, and the same precautionary measures. Now it has been stated, on the other hand, that oxalate of lime exists in the blood; and if this be so, we must regard it as a proof that a peculiar condition of system, or a diathesis separate from the uric, exists in these cases.

Let us consider the evidence we have in support of this latter view. While I am by no means inclined to deny that the acid in combination with lime may have been obtained from serum, it appears to my mind highly improbable that it is an *educt* of analysis. It is beyond dispute, indeed, that if a specimen of serum be acted on by evaporations,

boilings, and the like, which are necessary steps in our processes, any urate or uric acid present in it will undergo a change, more or less complete, into an oxalate, and this will immediately react on the calcareous salts. The result obtained therefore, by no means proves an oxalate to have existed in the serum operated upon. Those who have assumed oxalate of lime to exist in the blood, have felt some considerable difficulty in explaining how a salt so very insoluble should be found dissolved; and much ingenuity has been displayed to little purpose in respect to this chemical point. Thus, Dr. Schmidt, of Dorpat, chose to assume that there was a tendency to the formation of a soluble triple salt, composed of oxalic acid, lime, and albumen (oxalsaures, albumin, kalk), which by its decomposition might allow oxalate of lime to crystallize. There is no occasion, however, for this nor for any other assumption of unlikely conditions, and the following facts will, I think serve to impress upon the mind the more correct view of the question.

If urine, loaded with the lateritious sediment (urate of ammonia*), be gently heated, the whole deposit, as is well known, will disappear. On allowing the specimen to cool, the sediment is generally

* This common deposit is said by Lehmann and by Heintz to be composed of urate of soda, with small proportion of urate of ammonia and of lime.

again observed; but if we compare microscopically the sediments as seen both in the urine after secretion, and as re-deposited after solution by heat, we shall, in many cases, find a quantity of crystals of oxalate of lime in the last. So complete sometimes is the change effected, that the original deposit never appears again; while we find, on allowing the urine to stand a few hours, that oxalate of lime is present in abundance. These facts will show how impossible it is to determine whether or not oxalic acid or its compounds really exist in the blood by a method of analysis requiring the application of continued heat.

It is to Dr. Aldridge, of Dublin, that we are indebted for a most complete explanation of the manner in which uric acid and its compounds become decomposed into an oxalic salt by heating urine. He has proved that uric acid may be theoretically considered as representing the elements of oxalate and carbonate of ammonia, hydrocyanic and formic acids, if we merely add to its atoms the elements of water in varying proportion. He has demonstrated that this really occurs; for by heating urine, and in some cases by evaporating it, he has succeeded in causing a deposit of oxalate of lime, while evidence of the presence of hydrocyanic and formic acids could be obtained from the fluid.

The following diagrams show how the elements may be arranged as above described: —

	C.	N.	H.	O.
2 Atoms of Oxalate of Ammonia	4	+2	+6	+6
2 Atoms of Formate of Ammonia	4	+2	+8	+6
2 Atoms of Carbonic Acid - -	2			+4
	10	+4	+14	+16=
1 Atom of Uric Acid - - - -	10	+4	+ 4	+ 6
10 Atoms of Water - - - - -				10+10
	10	+4	+14	+16

	C.	N.	H.	O.
2 Atoms of Oxalic Acid - - -	4		+	6
2 Atoms of Hydrocyanic Acid -	4	+2	+2	
1 Atom of Urea - - - - - -	2	+2	+4	+2
	10	+4	+6	+8
1 Atom of Uric Acid - - - -	10	+4	+4	+6
2 Atoms of Water - - - - -				2+2
	10	+4	+6	+8

The chemical evidence of the existence of compounds of oxalic acid in the blood, is, to my mind, most imperfect; while, on the other hand, there are facts which it is difficult to explain, except on the supposition that the so-called oxalic diathesis is nothing more than an accidental and unimportant modification of the uric.

The fact stated above, that the urates are easily decomposed into oxalic salts by a gentle heat, has been too much disregarded, and was certainly at first unknown to the originator of the view that oxaluria constituted a diathesis. That it was even at a later date entirely overlooked, is proved by the cases published, in many of which we find the

presence of crystals of oxalate of lime were demonstrated by applying a gentle heat to urine containing a full deposit of the urates, and then subjecting the deposit obtained to microscopic examination. There is not a particle of evidence to show that the oxalate of lime was originally present in these cases, and the probability is, that the patients were merely excreting the urates. In these remarks I do not wish it to be supposed that I disbelieve in the existence of the oxalate in small quantity in many urines containing the urates. It is undoubtedly often present with it; but I wish it to be remembered, that when the oxalate *is not* present, it can be *produced* in urine from the urates by the process of heating, a mode of proof which was used, and is even now used by some.

The foregoing remarks have chiefly had reference to cases in which the urates appear as a deposit. Let us now consider whether or not the cases in which we observe the oxalate of lime crystals as a deposit, unmixed with the urates, may be placed in the same category.

Have we any proof, it may be asked, that in these cases the oxalate of lime is a derivative from the urates? Chemically speaking, we know such conversion is easy, and, moreover, on chemical grounds we know that the experiments on the blood, which have been performed with the view of determining that oxalic acid, or its compounds, exist in it, would have given the results recorded,

even had no oxalic salt been present, provided there had been a uric acid salt, which could be acted upon by the heat used in the processes. We have thus an easy and simple explanation to oppose to one of a most uncertain character.

It has been long known, from the experiments of Dr. Garrod, that uric acid exists in healthy blood, while in gout it is always present in increased proportion, so that we need not be at a loss to explain the origin of the oxalate of lime obtained.

It may possibly occur to the minds of some, that so distinctive a set of symptoms have been observed to accompany the excretion of oxalate of lime by the urine, that a pathological difference must be admitted, notwithstanding the facts adduced by opposing chemical results; and it is on this part of the subject that I would now remark.

Let us first consider whether we do not occasionally observe severe symptoms in cases characterised by a deposit of urates, identical in kind as well as degree with those observed in oxaluria; and whether, again, we do not occasionally observe in oxaluria an almost entire absence of symptoms, or symptoms of trivial character, and identical with those most frequently noticed where the lateritious sediment prevails.

On the first point I would observe that nearly all dyspeptics occasionally pass urates, and that the severest symptoms of hypochondriasis are to

be met with in such cases, without the oxalate necessarily appearing in the urine. On the second point I can most confidently state, that I have had cases under care in which the excretion of oxalate of lime has gone on even to the production of calculous disease, in which hypochondriasis and irritability have never been prominent symptoms. I have, in fact, entirely failed to detect the peculiar pathological conditions, which have been said to connect themselves with the oxalic acid diathesis, and am every day more confirmed in my opinion that it must be regarded, as I have before suggested, as an accidental and unimportant modification of that most significant variation from health which consists in the excretion of uric acid, or its compounds, in abnormally increased proportion.

It can scarcely fail to occur to the minds of those who are busily watching disease, that this last proposition involves the necessity of proving that the gouty diathesis is present where oxalate of lime prevails. We all know how constantly calculous disease, in the uric acid form, is associated with the gouty habit, and few practitioners can have failed to observe how in early life a tendency to gravel and stone will sometimes gradually decrease as the adult period approaches, and how such patients in after life become martyrs to gout. Again, in the prime of manhood we occasionally observe lithiasis speedily giving

way to gouty seizures. Do we observe this, it may be asked, in oxaluria? Does oxaluria form a symptom in gouty subjects? To this I can give an affirmative answer. But it may be asked, Is it *often* present? To which I would reply, quite as often as can be expected from its comparative frequency as a detected deposit. I use the expression, "detected deposit," because the oxalate of lime constantly escapes notice, whereas the uric deposits are obvious to the patient. It is for this reason alone, I believe, that the connection between gout and oxaluria has so long remained unknown, or matter of doubt, to the profession.

As regards the point whether in such cases of gouty diathesis the oxalate may exist alone, or whether it must be always in admixture with uric acid or urates, or with both, I may state, that I have seen it in these gouty subjects quite pure, or rarely admixed with uric acid or urates. The observations I have made with respect to gout, have indeed only tended to confirm me in the view I now advocate, and had anything further been necessary to urge its correctness on my mind, I should have found it in the cases quoted by those who have advocated the view that oxaluria is the result of an especial diathesis. The symptoms detailed by such observers, if at all severe, will be found to accord with those experienced by gouty individuals who have inherited the tendency

without developing its ordinary symptoms, where the gout is suppressed, and dyspepsia appears.

The flatulence, the palpitation of heart, the despondency, pain over the region of the stomach, and the tendency to constipation, are well marked.

Bearing in mind the view here taken, I would now beg attention while I proceed to a short analysis of certain cases which have been quoted as especially illustrative of the oxalic diathesis, and I think the result will be that most, if not all of my readers will feel inclined to place them in the same category with those characterising the uric diathesis.

I will now notice, as concisely as possible, the illustrative cases given in the work on urinary deposits, by the late Dr. Bird.

Case I.

A gentleman, aged 30, of melancholic temperament and highly susceptible feelings. Four years ago he contracted a sore, supposed to be syphilitic. Treatment by mercury and iodine brought on a cachectic condition. After long travel, he became hypochondriacal, and despairing of cure, expected to die of syphilis or phthisis. He was in an ir-

ritable state; had lost flesh; suffered from extreme palpitation; flatulent distension of colon; pain between the shoulders, and over the region of the stomach; constipation and excitability.

Urine contained urates, which, *on being heated*, yielded oxalate of lime crystals.

There is no evidence to show that such crystals were present before heat was applied, and this was probably merely one of those cases of emaciation and excessive excretion of solid matter so often characterised by the presence of an excess of urates.

Case II.

A gentleman of 53, a heavy feeder, drinking largely, but seldom becoming intoxicated; of active habits. Ten years ago was the subject of irritative dyspepsia; recovered, and was well for four years. He then relapsed, and had severe pain in the left hypochondrium, with distended colon and constipation. Suffered from severe lumbar pain five years ago, after exposure to cold; this now will return on indiscretion in diet. No headache nor sickness; urine turbid, and generally passed in large quantity. Has been hypochondriacal of

late; no inherited tendency to calculus or gout; bowels regular. Urine pale amber colour, containing mucus; not coagulable by heat. Urates deposit in abundance, with uric acid in lozenges; urea in excess.

The description of this urine after the lapse of a week I will give in Dr. Bird's words: — "Specific gravity, 1·030. It was acid, pale, contained abundance of urate of ammonia, which *by heat* disappeared, leaving distinctly visible, under the microscope, a copious deposit of oxalate of lime in minute octahedra, mixed with an abundance of nucleated epithelium; no uric acid."

In this urine we find that oxalate of lime was, however, subsequently observed before heat was used, and that it afterwards occurred mixed with uric acid. The case was from the beginning very like gouty dyspepsia, and its history terminates with the statement that the patient subsequently had an attack of irregular gout.

Case III.

A pallid woman, of 35, suffering from the effects of miscarriage and consequent hæmorrhage. Pain at pit of the stomach and gastrorrhœa; pain

across the loins; more intense on exertion; constipated bowels, flatus, with craving hunger and thirst. Urine full of urates, showing oxalate of lime *after heat has been applied.*

In this case we observe nothing worthy of remark. It merely shows the conversion of the urate into oxalate, and presents no peculiarities.

Case IV.

A tall, thin woman; emaciated; much mental distress; has had eight children; profuse leucorrhœa; is constipated; pain across loins; palpitations; pain over epigastric region; urine loaded with urates; oxalate present *after heating.* During the progress of the case, oxalate of lime appeared alone in octahedral crystals, and subsequently again with the urate.

Case V.

A tall man, aged 31, having the emaciated appearance of a diabetic. He is exposed to alternations of temperature; is irregular in his habits; unmarried; suffers from seminal emissions and melancholia; a beer-drinker to intoxication once or twice

a week; constant headache; pain over the loins; sense of sinking at stomach; sweats and feverish flushes; giddiness; memory failing; no thirst; appetite bad; palpitation and flatulence. Here the urine showed excess of urea, and octahedral crystals of the oxalate of lime were present without being produced by heat from the urate, which latter was not present.

This case shows no peculiarity. It is that of a drunkard suffering from dyspepsia, with tendency to excrete an excess of urea, and consequently showing emaciation. The urine depositing the oxalate must be regarded as merely the result of an urate changing after secretion; the symptoms being those commonly observed in drinkers, whose kidneys so frequently secrete the urates. It is worthy of remark, that this case is said to have been greatly relieved by the administration of colchicum.

Case VI.

A pallid man, 58 years of age; of gaunt appearance; flush on the cheeks; has voyaged in the Levant, and led an intemperate life; now works as a cabinet-maker; has suffered from a wrench of the

loins. During the last twelve months he has lost strength; is low-spirited, and his memory fails; appetite bad; frequent nausea; flatulent distension; pain across loins; decrease of sexual appetite. Urine contains oxalate of lime, both in octahedra and dumb-bell crystals.

After this, uric acid appeared in the urine mixed with dumb-bell crystals, and, as the case progressed, uric acid alone was present.

Case VII.

A pallid, thin woman, aged 37, mother of two children; vague pains; eighteen years ago a blow on the right hypochondrium; has ever since suffered from pain, extending over the region of the right kidney. Since the blow, whenever the catamenia appear, she becomes jaundiced, a state always relieved by bilious vomiting. Every two or three months she suffers the pain over the right kidney. This passes off with a discharge of turbid urine; irritability of stomach then occurs; no hæmaturia.

This patient's urine contained abundance of urate, and showed the oxalate of lime *after heat-*

ing. It was a case of disease of kidney (probably calculus), and the oxalate observed was mostly, if not entirely, formed from the urate present by the heat used in preparing for the microscopic examination. There was over-lactation, and emaciation from that and from renal mischief, and the urine as secreted would naturally contain excess of urea and urates.

In summing up the evidence derivable from these cases, we have to deal with a broken-down syphilitic patient, a gormandiser, a gouty subject, women debilitated from leucorrhœa and miscarriages, and a man guilty of drunkenness in its worst form. How it has happened that from these illustrative cases, and others of the kind, a symptomology has been recognised, authorising the establishment of a peculiar diathesis, must ever remain a profound mystery. Half the cases may indeed be set aside, as merely showing the formation of oxalate of lime in the urine by heating the urates present as a deposit, while the rest are so like what we observe in the ordinary run of dyspeptic cases, and especially in the irritable dyspepsia of gout, that their relation to the urates and the uric diathesis need scarcely be doubted. The chemical reasoning, which shows how unlikely it is that oxalate of lime should exist in the blood, is quite borne out by the pathological bearing of the case; and the conclusion appears to my mind quite inevitable, that, whenever oxalate of lime is found in the urine, it should be

regarded as *produced after excretion*, and that there is no such thing existing as an oxalic diathesis.

Professor Lehmann, who has opposed the opinions expressed by the late Dr. Bird, has stated a fact which is to a considerable extent confirmatory of my views. He declares that morning urine, left to stand some hours, often contains oxalate of lime in quantity, when the fresh urine did not contain any trace of it. Wöhler and Frerichs have made an experiment bearing strongly on the view I advocate. They found that the urates, when injected into the blood, produced oxalate of lime in the urine.

In continuing this inquiry, let us next examine into the effects of treatment, and observe how results agree when the same remedies are used for the uric acid and for the so-called oxalic diathesis. The treatment most efficacious when large deposits of urates are observed, is equally beneficial where oxalate of lime is present. Purgatives, mild mercurial alteratives, and the mineral acids (especially the nitric acid), tend to relieve that state of the chylopoietic organs, and especially the liver, upon which the increased amount of urates discharged so frequently depends, and we have been long taught by experience that such treatment relieves those suffering from the so-called oxalic diathesis.

The idea that the mineral acids are *necessary* to the relief of the latter condition, is quite an error. Those who pass crystals of oxalate of lime may be just as easily relieved or cured by other remedies.

Soda, rhubarb, and calumba twice a day, and an alterative at night, answer every purpose, the tonic action being the great essential, whether it be produced upon the stomach by an alkali or by an acid.

There is a point of great interest in connection with the use of acids and of alkalies in the treatment of calculous disorders, which it is highly important to remember, and it is especially necessary to consider it when discussing the possible connection between uric acid and oxalate of lime as urinary deposits. I allude to the fact, that the mineral acids by no means acidify the urine to the extent generally believed by the profession. They may be persevered in for many weeks and yet the urine show little more than its normal amount of acidity. Their action on the organism consists in extracting alkaline matters, and when taken we find them in the urine as compounds of neutral salts. Again, in the case of alkalies we must not expect that alkalinity of urine is easily produced by their administration either in the caustic state or in the form of carbonate. With respect to potassa, I have observed the urine alkaline after exhibiting the carbonate in scruple doses for a fortnight, and I have great reason to believe that in most cases where the forms of alkali above alluded to have been persevered in, and then set aside as having failed, the urine has really never been rendered alkaline at any period of treatment. Now the acidity of urine being only in-

creased with difficulty, we can understand how the acids exhibited can do but little or no harm as acidifiers of the urine, while they will tend by their tonic influence to improve the general health and the state of the chylopoietic organs. If persevered in, however, and exhibited in full doses for a length of time, we may expect the urates which (we are assuming) produce the oxalate of lime by their decomposition, to undergo a more direct change; the base uniting with the acid exhibited, and the uric acid thus set free tending to show itself as a deposit. That this happens in oxaluria was long ago observed by Dr. Prout, and it is a fact easily accounted for on the theory I have proposed, which regards the presence of oxalates in the urine as indicative of urates in the blood. With respect to the treatment of urinary diseases by alkaline remedies, if we are to consider that term to signify remedies which render the urine secreted by the kidney of alkaline reaction, it is scarcely too much to say that such method of treatment has never yet had a fair trial from the profession. Now that the subject is beginning to be better understood, and when the agents which effect the change with facility (such as the alkaline citrates, tartrates, &c.) are being used, the relief obtained by cases under treatment contrasts strikingly with the results observed in those subjected to the old *régime* of caustic and carbonated alkali.

Before I quit this part of my subject, I must

request attention to a fact which must not be overlooked in these days when practitioners are perhaps over-anxious about the state of their patients' urine.

The urine passed by all persons suffering from diseases producing emaciation, contains much solid matter as a result of a waste of tissue. Such urine is frequently highly charged with the urates, and this is often mixed with oxalate of lime, and we can always produce abundance of the latter by heating such specimens. These urines may by some be regarded as significant of the oxalic diathesis or the lithic diathesis; and should the secretion of water by the kidney suddenly come on in excess, as sometimes happens, we may make the mistake of regarding the case as likely to go on to diabetes. This pathological view, founded on the old notion that oxaluria is allied to the saccharine diathesis, I have known in one instance so completely to occupy the mind, that the existence of extensive and eventually fatal disease of the lungs was entirely overlooked. The urine was sedulously examined day by day; its specific gravity observed; the quantity of fluid and solid taken as ingesta carefully noted; and while all this deference was paying to that which was merely a symptom of emaciation, phthisis was working its mischief with deadly certainty. Never neglect to make careful physical examination when you observe the urates passing frequently and copiously.

I feel that one of the most important bearings of the conclusion I have drawn regarding the so-called oxalic diathesis, consists in placing it among those indications which should serve to put us on the watch for symptoms connected with the gouty state. In some cases this will undoubtedly show itself; and if the view I have taken be borne in mind, the less prominent symptoms may receive that early attention so desirable for the comfort of the patient.

But let us now proceed to our more immediate object.

Regarding oxalate of lime merely as uric acid, or urate altered after secretion, a perusal of the lists of calculi contained in museums will show that the uric acid diathesis produces nearly the whole of the calculous disease observed in the human race. The other constituents of calculi are of such rare occurrence, that, were it not for uric acid, calculus would be less frequently met with than tetanus.

In the foregoing remark I have entirely neglected the consideration of the earthy phosphates as constituents of urinary calculi. My reason for this is, that I have little doubt we must regard their formation entirely as an effect of the mechanical action of other calculous matters. If this view be taken, then we may very securely come to the opinion above expressed.

Let us now consider the question of the earthy phosphates.

It was remarked many years ago by Dr. Prout, that these salts, when present, were always found covering other deposits, and rarely alternating with them; so that if the nucleus were phosphatic, the crust would be so also, and no covering be found composed of any other form of calculous matter. On the other hand, all forms of calculous matter might be found covered with the earthy phosphates in the construction of a calculus. This fact alone seems to authorise the generalisation I would propose; and had it not been that the deposition of the phosphates has been allowed to connect itself so strongly with the idea of an associated diathesis, the many facts bearing on the case must long ago have led observers to the more correct view of the subject.

I have on several occasions brought before the profession both chemical and pathological facts tending to prove that a deposit of the earthy phosphates is rather the result of disease of the urinary mucous surfaces, than of any other condition; and it is not necessary here to enter upon the general question. For the present it will be enough to call to mind how the irritation produced by foreign bodies accidentally introduced into the bladder is always followed by evidence of inflammation, and by a subsequent deposit of earthy phosphates. The dependence of this on the alkaline nature of the

fluid poured out from the irritated mucous surface, I have treated of at length in published memoirs *, and I have here only to add, that experience is daily strengthening my conviction of the truth of that view.

In whatever the action of the mucous membrane of the bladder may consist, it must of necessity be admitted that the presence of uric acid, or any other form of concretion, is a sufficient cause for the production of phosphatic layers to a calculus; but the question will arise as to how phosphatic calculi are formed, when no other kind of calculous matter can be detected as a nucleus. In such cases, what were the conditions antecedent to the phosphatic deposit, and have we any means of combating the tendency?

So far as I have been able to inquire, these calculi are but rarely met with, and, when present, are observed only in cases where the mucous membrane of the bladder has become greatly diseased, and where, of necessity, we have the

* Lettsomian Lectures, Medical Gazette, 1851. — Mr. Blizard Curling (Medical Gazette, 1835-36, p. 325) has made some excellent observations on the subject of alkaline urine occurring after injury to the spine. He alludes to the action of secreted mucus, and the possible production of decomposition and alkalinity in the urine. In my belief, the simple admixture of the urine with the alkaline fluid secreted by the mucous membrane of the urinary passages and bladder is the cause of alkaline urine and phosphatic deposit in the great majority of cases coming under treatment.

alkaline secretion poured out from it in quantity. This state of things, as is well known, often follows upon enlargement of the prostate, with stricture, so that the bladder is not easily emptied; portions of urine always remaining in the bladder after micturition. These retained portions will have their earthy phosphates precipitated by contact with the alkaline secretion of the diseased mucous membrane. In this state of matters it is easy to imagine how a calculus may form.

The constant presence of this cause for precipitation accounts for the great size attained by these concretions, filling, as they occasionally do, the whole of the bladder. In some cases of this description we find the previous history indicating the uric acid diathesis. Such patients, indeed, may have passed uric acid calculi on former occasions, and it may have been from their presence that the bladder first became involved in disease, their removal having left a state of bladder favouring phosphatic deposit.

Having now considered the questions, 1st, of the manner in which the presence of other calculous matters tends to cause a deposition of the earthy phosphates, and 2ndly, the cause in action for the production of phosphatic calculi, independently of such nucleus, I will proceed to treat of the theory on which the formation of calculi appears most easily explained, and describe the successive

stages of change in the urine by which their chemical constitution may be varied. It must be borne in mind, however, that any of these stages may persist throughout, and that then the calculous matter deposited will continue the same in character, and the calculus formed contain only one ingredient, — or fewer ingredients, as the case may be, than when the urine undergoes all the stages I am about to describe.

Since uric acid forms the nucleus of the great majority of calculi, I shall begin by considering the conditions under which we may expect its deposit to occur. Some of Scherer's recent researches bear upon this part of our subject. That chemist believes that the deposition of uric acid from the urine is owing very frequently to a metamorphosis of the urinary pigment. A certain kind of decomposition appears to occur in this substance, and by successive changes there is developed in the urine an amount of acidity very obvious to the examiner, and this is accompanied by the deposition of uric acid. Ordinary healthy urine takes on this action when exposed to air at the ordinary atmospheric temperature, and it always precedes that decomposition which occurs after the lapse of many days, and which is known by the development of carbonate of ammonia and the production of a strong alkaline reaction. To this spontaneous acidification Scherer has given the name of "the acid urinary fermenta-

tion." He fixes the duration of this action at from four to five days; but under certain states it would appear to last even much longer than this. Scherer's view of the nature of this process is, that the mucus of the bladder acts as a ferment on the extractive pigment of the urine, and that we have a quantity of lactic acid developed as the result. Liebig and Lehmann have recognised the production of acetic acid also during this process.

If we separate the mucus from healthy urine by filtration, we find we interfere completely with the development of this acid fermentation; and it may also be either delayed, or entirely done away with, by boiling the urine, or by adding a little alcohol to it, — facts which indicate the close analogy the process bears to other recognised forms of fermentative action.

In this production of acid, Scherer recognises the cause of the deposition of uric acid; and when the mucous ferment exists in more than usual quantity, he believes that urine retained beyond the accustomed period in the bladder will deposit uric acid, and thus form the nucleus for a calculus. Now, though this change may take place in urine after expulsion and exposure to the air, it is far from certain that it can occur in the bladder, or in the urinary tubular structures; and, moreover, we have quite a sufficient cause for the deposit of uric acid, without

having recourse to this acid fermentation in order to explain the fact. The greatly increased quantity and the insolubility of uric acid will serve to explain all; while, on the other hand, it is difficult to understand how a process of fermentation can occur in those parts of the urinary apparatus where nuclei are most frequently formed, — viz. in the nephritic structure, where the urine is draining away nearly as fast as it forms. Under such conditions, however, we can easily understand how an excess of a difficultly soluble substance may deposit.

If the deposition of the uric acid in the calculous form happen to create but little disturbance, and fail to produce any great irritation of the vesical mucous membrane, then the calculus will become enlarged by the continued deposition of uric acid layers; but if (as is generally the case) this foreign body irritate the surfaces, then the bladder becomes inflamed, and the mucous membrane throws out an alkaline fluid which I believe now decomposes the ammoniacal salts contained in the urine, and liberates the ammonia. This may unite to a portion of uric acid, forming urate of ammonia; so that the next layers of the calculus may consist either entirely of urate of ammonia, or of that salt in admixture with uric acid. The changes may cease here, and the calculus, though it increase under these conditions, be thus compounded merely of two constituents.

The next change may, however, occur, and may determine the formation of a more compound form of concretion, and this will consist in the pouring out of an *excessive* quantity of alkaline secretion by the inflamed mucous surface.

This will not only completely neutralise the acidity of the urine, but cause (like all alkaline solutions) a precipitation of the earthy phosphates. These will coat the calculus intermixing or not with the urate of ammonia or uric acid, according as it may or may not happen that during their adhesion the membrane (from the effect of remedy or other cause) may pour out its secretion in less quantity, and allow the formation of compound layers of urate of ammonia and phosphates such as are frequently observed in calculi.

From what has been stated of the action of the fixed alkali contained in the mucous secretion, it is easy to understand how, during these changes, urate of soda (which is a common constituent of compound calculi) may be found in admixture.

Scherer and Lehmann have attempted to explain the production of this alkaline state of urine on the theory of an alkaline fermentation, which they believe is induced, like the acid fermentation, by the presence of changed urinary mucus. There is no occasion, however, for this mode of explanation; and a strong argument against it is, that the mucous membrane changes acid urine to the al-

kaline state *immediately*, whereas time would be required to effect fermentation.

There is, in point of fact, a sufficient cause in action rendering alkaline fermentation, should it occur, a matter of secondary importance, so far as affects the result.

Much confusion has arisen in connection with this subject, owing to the fact that urine becomes ammoniacal during these changes. This has induced the belief that urea is always decomposed.

Now, although this certainly happens after some time has elapsed, it is by no means necessary for the production of ammoniacal urine, inasmuch as we find that the alkaline secretion thrown out by the mucous membrane under inflammation produces ammoniacal urine simply by decomposing the ammoniacal salts present in it.* The secretion of

* The existence of ammoniacal salts in urine has been flatly denied by Scherer, Liebig, and Lehmann; but there is no doubt whatever that they exist in that excretion in very considerable quantity, as the following statement proves: — If we take healthy urine of its full acid reaction, and add liquor potassæ to it carefully, we shall find that when we have neutralised its acidity, ammonia is immediately evolved. There is no occasion to use caustic alkali, however; for, if we add a solution of basic phosphate of soda instead, which is a very mild form of alkaline solution, we still observe that ammonia is given out in quantity. If we now test the reaction of this urine, we find that the reddened litmus paper becomes blue, indicating the presence of an alkali; but on drying, it will again assume its red colour, showing that the alkaline reaction was caused by ammonia, and not by fixed alkali. But, it may be asked, how could this happen, since we used *fixed* alkali to produce the alkalinity? The fact is, that our fixed alkali is all neutralised

the mucous membrane owes its alkalinity to fixed alkali, and, therefore, when it mingles with urine it abstracts and unites with the acids of the ammoniacal salts, and liberates the volatile alkali.

I would here beg attention to the results of an experiment strongly corroborative of the views I have proposed, and which proves how completely and rapidly an inflamed mucous membrane can change the urine to alkalinity from its normal acid condition. I made the observation several years ago on a man whose anterior abdominal parietes were deficient. As is usually the case in such persons, the anterior portion of the bladder was also wanting; so that the fundus of that viscus, covered by mucous membrane, was projected forwards where the abdominal walls were deficient. The openings of the ureters were thus presented to view. The mucous membrane was red and inflamed from exposure, and an alkaline fluid was constantly discharging from its surface. To what this alkaline flux amounted during the day, it was, of course, impossible to ascertain; but it was more

by the acids with which the ammonia was previously combined, and the volatile alkali is set free to exercise its power on the reddened litmus. Thus, supposing the ammonia to have existed as phosphate and hydrochlorate in the urine, the fixed alkali has combined with the phosphoric and hydrochloric acids to form salts of the fixed alkali, leaving the ammonia the only free alkali present. In these experiments beautiful crystals of the triple phosphate appear after a short time has elapsed.

than sufficient to destroy the acidity of the urine, which was quite alkaline after flowing over the membrane. Thus, if a piece of blue litmus paper was applied to the openings of the ureters so as to test the urine, immediately it flowed from them the paper was reddened, indicating that the urine was secreted of its natural character, and with its full amount of acidity. When, however, the litmus paper was applied about a quarter of an inch below the opening, so as to test the urine after it had passed over that short distance of mucous surface, its characters were quite changed; it no longer reddened the blue litmus paper, but, on the contrary, was sufficiently alkaline to restore the blue colour to those parts of the paper which had been previously reddened by exposure to the urine as it escaped fresh from the ureters.

This experiment plainly shows that we have in this discharge from the mucous membrane a sufficient cause for the production of an alkaline state of the urine, and consequently for the production of phosphatic layers on calculi, without having recourse to the theory of alkaline fermentation.

CHAP. II.

FORMATION OF CALCULI — CALCULUS IN THE KIDNEY — MALIGNANT DISEASE.

THE contents of the last chapter having had reference more especially to the chemical agencies in force during the formation of calculi, I propose next to regard the question in its mechanical and pathological bearings.

In persons who suffer from uric acid deposits we sometimes observe that the continued excretion of that substance is unattended by the formation of calculus. Attacks of "gravel," as they term it, may be of frequent occurrence, but moderate care and the use of ordinary domestic remedies prove quite sufficient to afford temporary relief. This is to be observed also where the urates abound, and it is surprising in what enormous quantities they may be present without showing any tendency to concrete into the calculous form. Now, while this pertains in a number of cases, we observe on the other hand, that where the deposits exist in far less proportion, a tendency to concrete into calculi is very early shown. This fact would seem to prove, that, in order to produce calculus, some condition must be present besides that which we recognise in a tendency to the deposit of solid matter from the

urine. Let us consider in what this superadded condition consists. It is necessary here to bear in mind what has been said respecting the action of the mucous membrane and the chemical effect of its alkaline secretion. This secretion, we are aware, can be poured out in considerable quantity during inflammatory action; but besides possessing the chemical qualities already noticed, it shows mechanical conditions which must greatly influence the result where a tendency exists to deposit of solid matters from the urine. The secretion from an inflamed mucous surface is more or less of a tenacious character: it contains fragments of epithelium and what have been called mucous corpuscles. From what we know of other mucous membranes, we have every reason to believe that the membrane of the bladder will secrete a fluid varying as regards the above mechanical properties, being sometimes nearly as fluid as water, and at other times tenacious and glairy, and loaded with mucous and other corpuscles, the results of higher inflammatory action. It is a difficult, if not an impossible thing, to make direct experiments on this subject. The mucous membrane of the bladder has its secretion constantly mingled with the urine, and consequently when distubance occurs in its function, we have not the means of detecting those modifications of secretion which we always observe when the bronchial and the Schneiderian membrane are in fault. The manner in which it affects the character of the urine

under severe disease is plain enough, but when slighter inflammatory action occurs it can scarcely be obvious to our senses, at any rate we fail to appreciate those minor derangements which analogy would lead us to believe must frequently occur. To such a state of mucous membrane, a state difficult of detection, I think we may very properly look for a solution of this question. A deranged condition of this surface, which will so modify its secretion as to favour the aggregation of deposits, must be such as tends to the pouring out of a fluid containing a larger quantity of mucous and other corpuscles. These will, by their mechanical action, cause small particles to unite, and become caught up and entangled with the organic corpuscles.

Among the many evils arising from the gouty diathesis I believe we may with justice number a tendency to this kind of action on the part of the mucous surfaces. In those who suffer from the disease in its irregular form this condition is very frequently observed. When we have the opportunity of watching such cases, we find that on some occasions the depost of uric acid observed in the chamber vessel does not assume the ordinary crystalline character. It appears in agglutinated masses adhering to the sides of the vessel. This state of the excreted uric acid was many years ago alluded to by Dr. Prout, who connected it with a tendency to calculous disease, which undoubtedly is the case, and analogy would seem to point to the

probability that it is the result of a diseased state of the mucous surface. The fact that, in some states of system, enormous quantities of the deposit may be passed without concretion being effected, is beyond a doubt; and it is equally certain that, under other states, the deposit rapidly agglutinates, and though what I now urge can scarcely admit of absolute proof, I would submit that probability favours the correctness of the view, that it is owing to the action of the mucous surface that the point is determined, whether calculus form or not.

According to this view of the case we must regard the existence of uric acid calculus as a result of co-operating causes; and so long as we can keep the mucous surfaces free from inflammatory action, and so prevent their pouring out the products of inflammation, we may hope to avoid the *concretion* of any urinary deposit from which the patient may happen to suffer.

The mechanical and chemical effects produced by the mucous membrane of the bladder in causing the formation of calculi, was noticed very early in the literature of this subject. Dr. Marcet and the Baron Heurteloup both alluded to it in reference to the deposition of the earthy phosphates; but, like many who followed them, misinterpreted the phenomenon.

Thus, while they declared that facts seemed to show that phosphatic calculi depended as much on the diseased secretion of the bladder, as on any

peculiarity of the urine secreted by the kidney, they considered the earthy phosphates to be absolutely secreted by the mucous membrane ; whereas, what I have adduced, would seem to place it beyond doubt that the membrane acts merely through its alkaline secretion, which precipitates the earthy salts from the urine.

It may, perhaps, suggest itself to the minds of some of my readers, that as calculi nearly always originate in the kidneys, it is to the conditions which we find in those organs, rather than to what we can observe in the bladder, that we ought to look for the chief cause of their formation.

At any rate, this would appear to apply so far as the production of a nucleus is concerned. A moment's reflection will serve to show, that we have the same conditions present in the kidney which we have noticed with regard to the bladder; that is to say, we have urine, and a mucous surface with which the urine comes in contact, and analogy points to its secretion possessing the same chemical qualities.

As respects the mechanical conditions presented by the pelvis and urinary tubules, they are of a character for more favourable to the agglutination of deposits than those observed in the bladder, We have smaller cavities and conduits to deal with ; and in the immediate neighbourhood of the tubules, be it remembered, the first deposited

matters are constantly coming in contact with the spheroidal epithelium, which under irritation rapidly desquamates, and which, from its form, must be regarded as more especially liable to entangle floating particles of deposit, and so to favour the formation of calculus.

The reasoning I have used with respect to the bladder, applies with full force to the formation and growth of calculi in the kidney.

From what I have now adduced, I would submit, that if we except cases in which calculi are formed of the four following rare substances, viz., cystine, carbonate of lime, silicic acid, and uric oxide, we may consider all calculous disease as originating in the gouty or uric acid diathesis.

This appears still more completely the case when we remember that one of these rare substances, the uric oxide, is nearly identical in composition with uric acid. Thus, if two atoms of oxygen be added to two of the oxide, one atom of uric acid results.

The following diagram will serve to illustrate this point: —

	C N H O
2 atoms of uric oxide - -	10+4+4+4
2 atoms of oxygen - -	2
=1 atom of uric acid - -	10+4+4+6

Having now described the mode in which urinary calculi appear to form, I shall proceed to consider

the consequences of their presence in the several structures in which we find them contained. A nucleus may form in any part of the urinary canals; but the urinary tubules would appear by far the most frequent seat for the commencement of the deposit. In this way, small particles are sometimes found existing in the cortical or secreting portion of the kidney; and if these do not pass forward to the larger tubular structure, they may increase by deposit of successive layers, till a calculus of considerable size is produced. This will destroy a portion of the organ corresponding to its development, and produce a set of symptoms varying according to circumstances. This first deposited particle may, however, pass lower down into the tubular structure, or may find its way to the pelvis of the kidney, and there adhere.

Now, when a calculus exists in the kidney, symptoms vary greatly both in kind and in degree, and it is to the constitution of the patient that we ought to look most anxiously before giving our prognosis. The class of cases in which calculus exists in the kidney, producing severe symptoms during life, and in which the calculus never passes down into the bladder, is a very numerous one. The termination of these cases is governed according to constitutional conditions, either by relief being afforded, owing to a cystic covering forming over the deposit, or by death from disease

of the kidney. We will first notice those cases which terminate favourably.

When a patient of robust constitution becomes the subject of renal calculus, we find, generally speaking, very marked and severe symptoms, familiar enough to practitioners, and caused apparently by movement of the calculus towards the ureters. The severe pain in the loins, sides, and abdomen; the nausea, vomiting, and hæmaturia, point plainly enough to the nature of the case. By degrees this lessens, and the patient completely recovers; while the practitioner consoles himself, perhaps, with a hope that, if there have been a calculus to produce the symptoms, it must be very small, or perhaps that the deposit may be merely in the form of gravel.

Cases characterised by the same symptoms as the above, but marked by sudden relief, generally belong to another class, so far as their termination is concerned, going on to the production of vesical calculus, the relief so suddenly experienced resulting from the passage of the solid body into the bladder. I shall hereafter speak of these vesical calculi;—but to continue the cases where relief from pain is *gradual.*

Patients who suffer in this way are apt to have a return of symptoms after a day or two, and are restored to health only after a series of attacks. It is often difficult to persuade them that there can be anything in their kidney; and after a year or two

of impunity, they will hint that a mistake must have been made in their case. They are not likely to be satisfied with less than the production of the stone, if they have once heard of it, and this may only see light on a post mortem examination, and, therefore, too late to produce a modification in their opinion. When treating such cases, the practitioner had best explain at first the relief of symptoms, which may probably take place by the calculus becoming encysted, a termination, I have reason to believe, not always sufficiently expected by the profession. In these efforts to escape, if we may be allowed the expression, the calculus may fail to produce all the symptoms I have described. Thus we may not have pain in the loins — perhaps only a heavy dull pain on one side of the abdomen ; and, if the calculus be in the right kidney, there may be occasional violent tormina over the region of the gall duct, which may lead to the supposition that a gall stone is passing, and that the kidney is in no way concerned in the production of the symptoms. This conclusion, again, is often favoured by the fact, that when the spasm and pain attending these movements of the calculus are severe, and the right kidney is involved, the patient becomes jaundiced. A case of this kind occurred to me some little time ago in the person of a lady, who had on a former occasion suffered from excruciating pain over the right side of the abdomen, attended with nausea and vomiting.

The urine had been high coloured, and its tint probably considered the result of biliary impregnation. The symptoms when I saw her corresponded with those of the former attack, but were less severe in character; the urine was not so high coloured, and there was merely slight yellowness of skin. On examining into the case I found however that the secretion of urine was often irregular; that the patient was gouty; and lastly, that the urine on standing yielded a deposit full of blood corpuscles. The result of treatment put the question at rest very satisfactorily, and I have reason to hope that the calculus will become encysted and never again give cause for anxiety. With respect to the detection of blood in a case such as that just detailed, it is only when the corpuscles are abundantly seen under the microscope that I would presume to speak confidently; but it must be remembered that blood in urine may escape observation by the naked eye, or give only suspicious appearances when present in sufficient quantity to be very valuable as a diagnostic indication.

The situation of the pain occurring as it sometimes does rather in the abdomen than the loins, gives the sufferer in the cases I am describing a most distinct sensation of intestinal fulness and uneasiness. I have known this so completely to disguise the real nature of the disease, that even when the urine was passed, obviously tinged with blood, that significant symptom failed to induce a belief

that the urinary organs were implicated. I have known the practitioner anxious as to the probable existence of a hernia, and all this because due attention was not given to the state of the urine.

I will next treat of a class of cases dependant on renal calculus, and characterised by little else than hæmaturia. These patients may scarcely experience any pain; and, if there be occasional uneasiness over the lumbar region, it is such as causes but little anxiety. They find, however, that, after exertion, blood appears in the urine.

In these cases it is generally the oxalate of lime calculus that exists in the kidney, and small quantities of blood are almost continually draining away. If the hæmaturia be not observed by the patient we shall find day by day that there is a deposit of red corpuscles in the urine, provided we examine microscopically. The absence of pain, and the pallor occasionally induced by this small but continual drain of blood, are apt to mislead the observer, and to induce a belief that the symptoms are better explained by assuming the kidney to be involved in malignant disease, rather than that a calculus is present in its structure. The diagnosis is indeed somewhat difficult, and such cases require constant observation and much care in order to determine their true character. Malignant cells may perhaps sometimes escape, and be detected in the urine; but we must not count upon this. The chief point of distinction is, that there is less nausea

in these cases than we observe when the renal structure is more involved. We often derive help, too, from physical examination of the abdomen, where, if a tumor be detected, the probability is greatly in favour of malignant disease being the cause of the hæmaturia.

I shall next notice a form of disease which it is very important to diagnose correctly. It is one of the most distressing conditions under which persons of active habits can well suffer. In these cases the renal calculus, when formed, creates continual sympathetic irritation of the bladder. There is frequent call to micturate, and there may or may not be a previous history of hæmaturia. There often is, and it may have occurred more than once. Lumbar pains may also have existed, passing off, but little noticed, under the title of lumbago. The irritability of bladder may not be observed till some time after the hæmaturia and other symptoms have disappeared. These cases were first brought under notice by Sir Benjamin Brodie, as produced by disease affecting the kidney, and since that time those who have seen practice in urinary disease cannot have failed to observe their frequency in connection with renal calculus. They were in all probability formerly regarded as instances of irritable bladder or inflamed bladder, and were treated as such with little benefit. The disease most frequently occurs in persons between the fortieth and fiftieth year. There is generally a good deal of languor present,

and rigors and profuse perspirations are early observed. During the progress of the disease the urine becomes secreted of rather light colour. Occasionally, however, it is loaded with lithates, and, after a time, pus appears as a deposit. This may not be secreted in quantity for a length of time, but, if once observed, it is rarely absent from the urine. The pathological condition present would seem to be a gradual development of abscess of the kidney, and it is surprising how long such cases go on before the severer symptoms set in. The frequent desire to pass water may pertain for several years, and pus be passed in small quantity during the whole of that time before fatal symptoms show themselves; and, more than this, the patient may suffer from severe hectic, which, though it leave him exhausted, will not so far have injured him as to prevent him regaining the ground he has lost. It would appear that these exacerbations when they occur, are dependant on fresh portions of renal structure becoming involved in suppurative action, and it is by a series of such evils that the patient is eventually worn out, dying sometimes with sudden effusion on the brain. Above all things, never allow instruments to be used in cases like these. It happened to me very lately to observe the great mischief which may be thus inflicted. The symptoms were mistaken as indicative of some disease near the neck of the bladder; dilatation was determined on, and practised heroi-

cally. After what I saw as the result of this treatment it is wonderful that the patient still lives. His sufferings will, however, scarcely pass from his memory. We do not observe anything like stricture or difficulty in passing water in these patients, and when they come to us without any history of previous hæmaturia, we must not suppose they of necessity have renal calculus. There may be abscess from other cause. If, however, hæmaturia is or has been a prominent symptom, and we find on examination that the urine contains pus, we shall generally be right in coming to that conclusion. The importance of examining deposits is here prominently shown; for, were we merely to test the urine, we could never come to a satisfactory diagnosis between this affection and the morbus Brightii. In this latter disease we often find a history of hæmaturia, and the patients constantly complain of frequent desire to pass water. If we examine the urine, it is albuminous. Now, if we examine the urine in the cases to which I am asking especial attention, we shall also find albumen in it. It is to the nature of the deposit then that we must look in order to frame our diagnosis; and by microscopical examination, we shall find in these cases of renal calculus that pus is present, which is seldom or ever the case in morbus Brightii. This pus accounts for the albuminous urine attending these cases; and if we succeed in relieving these patients, so as to rid their urine of pus, all albumen will dis-

appear; whereas, if the kidney suffer from Bright's disease, it will be found albuminous, irrespective of the deposits contained in it.

The fact that these cases of renal calculus are by no means always productive of acute symptoms such as characterise the passage of calculus down the ureters, renders their diagnosis by no means an easy matter in all cases. We are in great measure dependant on the aid of the microscope, in order to determine the presence of blood and pus; two indications which, when persisting from day to day, become most significant.

The mistake which is sometimes made in regarding the symptoms I have detailed, as connected with a diseased state of the bladder, is a very serious one. When this happens, we sometimes find, that in consequence of no benefit accruing from ordinary remedies, the practitioner is induced to sound the patient. This, if once done, is generally repeated, the symptoms originally characterising the affection becoming much aggravated, and the termination of the case materially hurried. Improved pathology is rapidly lessening the number of reputed cases of diseased bladder, placing them in the category of sympathetic affections. It may, indeed, be regarded quite as an open question, whether we have a right to believe in inflammation occurring in the bladder, irrespective of mechanical cause or the presence of some chemical irritant, and otherwise than as the effect of

long-continued sympathetic irritation. Thus the presence of calculus or of urine decomposing in the bladder, may perhaps cause inflammatory action; but beyond this, the viscus, like the stomach, appears little prone to inflame.

In connection with the subject of calculus in the kidney, I have here to notice the pathological condition described by Rayer under the title of "Pyelitis." This, which is essentially an inflamed condition of the pelvis of the organ, may be the effect of several different causes, and is very frequently a result of the presence of calculous matter. From what I have already said of the formation of calculus in the kidney generally, it will be obvious that the pelvis of the organ presents all the conditions required for the rapid growth of calculi should urinary salts deposit, while an inflamed state of the lining membrane produced by any cause, will be productive of a tendency to a deposit of the earthy phosphates.

My chief object in alluding to this part of the subject, however, is to suggest, that in many cases of pyelitis and abscess of the kidney, *apparently* commencing in the pelvis or the immediate neighbourhood, the mischief has been produced by the inflamed urinary tubules pouring out alkaline fluid, precipitating the phosphates from the urine as it flows away, and thus causing obstruction, then inflammation, and eventually suppurative action.

This state of things is exceedingly probable in

cases of abscess of kidney, connected with old stricture, in which the bladder becomes distended with retained urine, and when it is seldom thoroughly emptied on micturation. Here the ureters become enlarged and their coats thicken, the pelvis of the kidney inflames, and suppurative action eventually sets up. If we examine the organ carefully, we generally find small abscesses throughout its structure, and here and there the tubes may be seen filled with earthy phosphates.

In abscess of the kidney from all causes, we sometimes find calculi existing in or near the pelvis, and when present they are nearly always composed externally of the earthy phosphates. If they be all phosphatic, we may conclude that the pyelitis has produced the calculus; but if there be a nucleus of uric acid, or oxalate of lime, then the calculus has in all probability originated the pyelitis, which when once set up by the irritation produced owing to the presence of the uric acid or the oxalate, will rapidly cause the calculus to become coated by the phosphates.

This same rule, of course, applies to the structure of vesical calculi. Thus, if they be all phosphatic (which very rarely happens) we may conclude they have originated in an inflamed state of the mucous surface pouring out its secretion and causing precipitation, as in cases of paralysis where urine is long retained, imperfectly voided, and decomposes in the bladder.

If, on the other hand, we find a nucleus of uric acid or oxalate of lime, we may conclude that the disease of the bladder has originated in the presence of the calculus.

Having now noticed some of the more important conditions connected with the existence of calculous matter in the kidney, I shall pass on to consider the subject of calculus in the bladder in its medical bearings.

Cases of calculus in the bladder do not present that variety in their termination, nor that diversity in symptom, observed when the kidney is so affected. Constitutional conditions, though they undoubtedly have their influence, do not exercise that marked power shown in the latter case. The reason for this is sufficiently explained in the fact that the kidney is a secreting organ, and therefore has numerous and important sympathetic relations, which scarcely pertain with regard to the bladder, as an organ merely destined for the reception of its secretion. I shall not detain you with a description of the symptoms of vesical calculus, but shall proceed to notice the cases which have been, and are even now, sometimes mistaken for it, commencing with one of the most fatal forms of disease. We will suppose a case presenting all the usual symptoms of vesical calculus, so much so that we are desirous to confirm our suspicions by mechanical examination. There may be pain at the end of the penis, frequent call to micturate, hæmaturia

after exertion, and perhaps pain on the occurrence of jolting motion. We may feel confidence in the correctness of our opinion, but yet calculus may not exist. What are the conditions, then, under which these symptoms appear? The last few years have afforded us far better means of inquiring into this subject than our predecessors enjoyed. We are in a position to detect conditions which of necessity escaped their notice, and as happens in the history of all subjects under the application of improved methods of investigation, the phenomena thus rendered amenable to our powers, appear to multiply with surprising rapidity. Thus it happened with respect to kidney diseases, when the discoveries of Dr. Bright were published to the world, and when the less philosophical and more self-satisfied in the profession, unwilling to believe in their want of perspicacity, were heard boldly to affirm that kidney diseases were become far more common than in former years.

The cases to which I allude, and which may be, and have been frequently mistaken for vesical calculus, are in the present day much more easily recognised than heretofore; and we observe the apparent increase of their number in a very marked manner. They consist in a cancerous affection of the bladder, the deposit involving the mucous and submucous tissues; the former becoming replaced by, or covered with, villous structure. Sometimes the deposit appears more like

ordinary epithelial cancer. When we have, then, a case showing marked symptoms of calculus, we may find on sounding that no stone can be discovered. The operation is, perhaps, attended with profuse bleeding, and this may continue to such an extent that considerable anxiety may be felt for the safety of the patient. If a correct diagnosis be not now made, there is the danger that the sound may be again used, and much mischief inflicted on the patient.

Fortunately we have the means of determining the real nature of the affection even before sounding has been practised, and that too in a very satisfactory manner. When such a case comes before us we should always make careful examination of the deposited blood corpuscles. If the hæmorrhage have been caused by vesical calculus, we shall observe these bodies mixed merely with any one or more of the ordinary organic and sedimentary matters. If on the contrary the malignant growth have attained any size or development, a diagnostic sign is present, to which experience has shown me great confidence is due. It consists in the presence of cells characteristic of malignant growth. These, which are intimately intermixed with the blood corpuscles, have an appearance unlike that of any of the ordinary matters deposited from the urine, and afford us a means of diagnosis and prognosis such as can scarcely be attained by any other method of investigation.

These cells are of variable size, the smaller being about four times the diameter of a blood corpuscle, the larger twice that size, or even of greater diameter.

They are colourless and more transparent than the white corpuscles of the blood, and contain within them nuclei of varying size. These nuclei differ in number in each cell. Sometimes one only is present, sometimes four or five.

Though there would appear a general tendency on the part of these bodies to assume the circular form, they are for the most part of irregular outline. Sometimes a mass of them may be seen agglutinated together, and then they are more or less square, or they may approach to the hexagonal form. After many years' experience in the examination of urinary deposits, I can affirm that I have never seen corpuscles like these in the urine, except in cases of malignant disease; and without going into the question whether such bodies may not be detected in non-malignant structures, I should feel little hesitation in answering for the correctness of a diagnosis, if formed on the fact that these cells were present in the urine.

Though these malignant growths occasionally produce acute suffering, and especially so if occurring near the neck of the bladder, they cause but little distress if situated in other parts of the viscus. In the latter case, as the growth increases, there is

frequent desire to pass water, and this together with hæmorrhage to a greater or less extent, first urges on the patient the necessity for medical interference. In a case which lately occurred to me, and in which hæmorrhage was the cause of death, with scarcely any pain till within the last few days of life, this had been the case. This patient was the subject of the morbus Brightii, and the hæmorrhage might therefore in part be attributed to that condition. It was only by examination of the urinary deposit that a correct opinion could be arrived at. The diagnosis was verified by post mortem examination, the section showing a malignant growth in the bladder, and the kidneys in an advanced stage of granulation. It sometimes happens in these cases of malignant disease of the bladder, even when much advanced, that we are able to check the hæmorrhage very effectually by our remedies. Do not allow your opinion to be shaken by this, if you have seen the cells I have described mixed with the blood. As these cases advance we also occasionally observe less hæmorrhage for a day or so, and instead of blood we have a deposit resembling mashed fibrinous structure. This is the disintegrated malignant growth soaked in urine, as may be proved by microscopical examination. When matters have gone thus far, if the patient be sounded, which should never be done, the instrument may

bring away adhering and agglutinated portions of this deposit. Before microscopical aid was afforded us, this was the only way, and an imperfect way too, of throwing any light on these cases, and it is a mode of proof only applicable when the disease is very far advanced.

CHAP. III.

HÆMATURIA AS A SYMPTOM. — PUS IN URINE. — TREATMENT OF CALCULOUS DISEASE.

I SHALL now proceed to consider some other conditions which are extremely likely to lead to errors in diagnosis; the symptoms being much the same as those described at the conclusion of the last chapter. Thus a patient may complain of great irritability of bladder, which does not yield to remedies, and the urine may be occasionally tinged with blood, so that a suspicion of calculus will very naturally occur to the mind of the practitioner.

These symptoms may depend, however, on two other causes, viz., calculus in the kidney, or morbus Brightii. In the latter disease, when it assumes its more common and insidious form, the presence of blood in the urine is sometimes the first symptom attracting attention. This is generally accompanied by a frequent desire to pass water, a condition producing much disturbance during the night. An inquiry into the case will generally reveal symptoms indicative of morbus Brightii; but if the practitioner be not on his guard, as has sometimes happened, he may be led away by these more

prominent symptoms and mistake the case altogether.

The great point is to obtain an urine free from blood corpuscles, and this will be afforded after a few days' watching, when if, on examination, we find albumen still present, then the case is almost certainly morbus Brightii; if, on the contrary, albumen leave the urine at the same time with the blood corpuscles, then we are dealing with calculus either in the kidney or bladder. This conclusion is, however, only warrantable when we have determined the absence of all malignant cells, described in the last lecture as significant of a fatal form of bladder disease.

If morbus Brightii be excluded, and the case prove one of calculus in some part of the urinary apparatus, we must trust to history to settle its precise seat, and there is but little difficulty here. There may be the symptom of pain in the loins to assist us; and we may also find corroboration of the opinion that renal calculus is present in the absence of symptoms characterising vesical calculus.

My object in laying so much stress on the importance of discovering the real state of things in these cases where hæmaturia exists with an irritable bladder, is, that we may avoid the introduction of instruments. No one at all acquainted with the medical history of urinary diseases can have failed to recognise the very great evils arising from their use — the constitutional irritation, the

depression, and the exhaustion of nervous power. These have in all probability been too little considered; yet on reflection how important it must appear that due weight should be attached to the evils which may arise from sounding; an operation which in irritable and susceptible subjects has been known to cause death in a few hours. It is not a very unlikely supposition that deaths are every year accelerated, and perhaps sometimes absolutely produced, by sounding in cases of malignant disease of the bladder, morbus Brightii, and renal calculus. In speaking of diseases which may be mistaken for vesical calculus, it may have been expected that I should have earlier alluded to ordinary cystitis or inflammation of the bladder. If by this we are to understand that an idiopathic disease exists, consisting in inflammatory action occurring in the viscus, I am (as I have before hinted) greatly inclined to doubt its existence altogether.

We certainly often meet with acute symptoms in vesical calculus, but it is rather to a subacute inflammatory state that we are directed in order to form our ideas of an idiopathically inflamed bladder. Here we are taught to observe a ropy mucus in the chamber vessel, a frequent desire to pass water, and perhaps some pain at the end of the penis, though this is not so common. The question arises, in what category must we place these cases,

if they be not idiopathic inflammations of the mucous surface of the bladder ?

In some instances we have a calculus in the kidney, which produces a more than ordinary degree of vesical irritation. Gonorrhœal inflammation is another cause for the disease; but by far the greater number occur in old cases of stricture or enlarged prostate, or both, where the urine is apt to be retained and to decompose, the bladder never completely emptying itself on micturition. My friend Dr. Todd has endeavoured to connect some of these cases with the gouty diathesis, and inasmuch as calculous disease is occasionally a cause of the evil, there appears some reason for the belief. The effect on the bladder is produced, however, by sympathetic nephritic irritation.

I have not yet spoken of those cases in which we have a calculus impacted in the ureter. The symptoms observed during the passing of a calculus into the bladder are well known, and it is rarely that a concretion remains long in the ureter. When this happens, however, and the calculus is large, it sometimes becomes impacted, and severe symptoms arise. There is pain over the abdomen, nausea and vomiting, and perhaps constipation, so that the case may be mistaken for enteritis or ileus. By degrees these symptoms may abate — the calculus remaining fixed and causing dilatation of that portion of the ureter above the obstruc-

tion. The pelvis of the kidney next becomes dilated; and eventually the kidney may take on suppurative action, and the patient sink.

If from any cause the action of the opposite organ be also interfered with, so that the depurative action of the kidneys on the blood is altogether prevented, then we have more rapid death, and the blood will be found loaded with urea. This occurred in a case I saw some years ago, in which, on post mortem examination, the patient was found to possess but one kidney, owing to a congenital malformation. The disease had consisted in the blocking up of the ureter of the other organ by calculus.

Having now alluded to general pathological conditions, in some of which we observe blood, and in others pus in the urine, I will proceed to treat of the method we should pursue in each case, in order to trace the symptom up to its real cause, as this will accord with the mental process by which the truth must be arrived at in practice.

First, in the case of hæmaturia. If, on examining the deposit of blood, we find it free from malignant cells, and if, as has generally been the case, a sound has been passed, and no stone detected, while careful digital examination shows the prostate unaffected, then we are probably justified in concluding that the hæmorrhage proceeds from the kidneys or the ureters, and we must consider

to what conditions of those parts the hæmorrhage should be attributed. First, as regards idiopathic hæmaturia. This bleeding from the surfaces of the kidney, without any especial cause beyond exposure to cold or to the vicissitudes of climate in warm and damp localities, has been considered as rare by most writers. For my own part, it has so frequently occurred to me to detect the cause of such hæmorrhage in lesion of some organ, that I am much inclined to deny hæmaturia ever occurs, except as an indication of decided disease of the kidney or other part of the urinary apparatus. It is true that idiopathic hæmaturia sometimes occurs, together with hæmorrhage from other mucous surfaces, in those who ascend to great heights, and who consequently suffer the loss of that amount of atmospheric pressure which preserves the conditions of equilibrium necessary to the safe circulation of the blood; but we may at once exclude such cases as these from the consideration, as also hæmaturia from general scorbutic disease, or the hæmorrhagic tendency.

With respect to the appearance of the urine, Dr. Prout considered that, when blood tinctured the whole fluid, appearing equally dissolved throughout it, the kidneys were generally involved. This is an observation which experience certainly verifies. When such an appearance is observed, however, it mostly coexists or alternates with blood

as a deposit, and we may conclude that there is calculus in the kidney, or that the organ is the subject of some other diseased condition, attended either with great congestion, granular deposit, or malignant disease. The detection of the real state of matters becomes very important in such cases. The symptom is a prominent one, and the patient's friends are sure to press the practitioner urgently for his prognosis. Now, though in most cases, if calculus be present, the history or severity of symptoms will assist us at once to the truth, yet it sometimes happens that such evidence is not afforded; and this is more especially the case when oxalate of lime calculi are contained in the kidneys. Under this condition the urine may be bloody, and no other symptom observed beyond dull lumbar pains. If oxalate of lime crystals exist in the urine, there is also pain in the penis, which does not affect the glans penis, as in stone in the bladder; but, on the contrary, is most plainly felt at the root of the organ.

Now, though in these cases the hæmorrhage will generally follow upon some unwonted exertion, still it is not always so, and the case is thus greatly obscured; for we lose a most important adjuvant to our diagnosis. If the hæmorrhage is the result of any of those chronic states of disease to which the name "morbus Brightii" has been given, we may easily determine it to be so, for then the hæmorrhage will soon be found giving place

to other conditions, in which the colourless matters of the blood alone become effused. We have here only to wait; and, whenever the urine may be excreted of its natural colour, to test it for the presence of albumen; and, if this principle then be present in any quantity, without the colouring matter of the blood, we may be nearly certain that the further progress of the case will be marked by the continued excretion of natural-coloured urine containing albumen, and not by hæmorrhage, and that the patient is suffering from some form of the morbus Brightii.

If, however, the urine, on becoming of its natural colour after an attack of hæmaturia, does not prove to contain albumen, then we may feel nearly sure that the hæmorrhage proceeded either from a calculus in the kidney, or some malignant disease of the organ.

The diagnosis between these two conditions must depend on the observation of the following points: —

1st. In malignant disease the blood is generally passed in larger quantity than in calculus of the kidney.

2ndly. There is more frequent tendency to nausea *on slight occasion* than in calculous disease.

3rdly. Microscopic examination of the urine will frequently show pus or mucus in excess, if there be calculus; whereas, in malignant disease, this sign does not so frequently exist.

4thly. The appearance of those suffering from malignant disease of the kidney is nearly always indicative of a state of anæmia more or less advanced.

5thly. In calculus, hæmaturia generally follows upon some unwonted exertion.

6thly. Careful examination of the abdomen will frequently lead to the detection of tumour if there be malignant disease of the kidney.

With respect to this last indication, I have, after careful examination, succeeded in detecting tumour of the abdomen in several cases in which the origin of the hæmaturia was very obscure. It is always right, indeed, to make this kind of exploration whenever such cases are presented to us, and it should be several times repeated if nothing be detected at first. The bowels should be emptied by the action of aromatic purgative medicines, and the patient so placed during examination that the abdominal muscles are rendered as flaccid as possible. With respect to the use of purgatives, their exhibition previous to these explorations is often absolutely necessary before we can hope to arrive at the truth, should renal tumour be commencing. I lately saw a case of this kind, in which the origin of the hæmaturia was very uncertain until purgatives had been exhibited for several days, when the whole mystery was cleared up by the discovery of a tumour in the left lumbar region. In this case, as in several others I had previously seen, I was at

first so completely foiled in detecting a cause for the appearance of blood in the urine that I was nearly making up my mind that the whole mischief must consist in transudation from the urinary mucous surfaces. There was such slight lumbar uneasiness, and the history of the case was so deficient in symptoms, that it was scarcely possible the hæmorrhage could have been caused by the presence of a calculus, and the renal tumour had become developed with scarcely any other symptom than hæmaturia.

In this class of cases it sometimes happens that we are unable to detect any enlargement of the kidney up to a very late period. The symptoms will be slight. There may be, perhaps, more irritability of stomach than is usually characteristic of dyspepsia, — slight lumbar pains, and lassitude. The urine may contain blood but seldom, and weeks, and even months, pass without hæmorrhage. I speak now of such hæmorrhage as can be detected by the naked eye. If, however, we have recourse to microscopical examination of the urine from time to time, the case appears differently. We shall then find that blood corpuscles are nearly every day passing away in small number. These may be detected by allowing the urine to subside in a tall glass vessel, and then examining the deposit. It is always right, when blood has been passed from the kidney, that the urine should be examined at intervals by the microscope.

We thus have a means of ascertaining more correctly the effects of exertion in the production of hæmorrhage. A patient may tell you that he can ride, run, or row, without producing hæmaturia; but after such exertion, if he be the subject of calculus in the kidney, we shall always be able to detect blood corpuscles by the microscope, even though he betray no other symptom of the disease. It must be remembered that in treating of the diagnosis between calculus in the kidney and malignant disease of the organ, I am directing your attention to such cases of calculus as you will only occasionally meet with. In general the diagnosis is easy enough. Thus the patient will generally have, in connection with hæmaturia, severe loin pains, causing vomiting and retraction of the testicle, and other symptoms, clearly pointing out the true nature of the case; but the equivocal cases I am here alluding to are sufficiently common to make their study of some importance to the practitioner.

To sum up, I should say, in the first place exclude from the consideration cases of what has been called idiopathic hæmaturia, which can scarcely exist under ordinary barometrical conditions; secondly, exclude the hæmorrhagic diathesis; thirdly, determine that the case does not belong to the morbus Brightii, by ascertaining that when the red particles cease to appear the albumen also leaves the urine; and, fourthly, when the hæmorrhage

is placed within these limits, determine whether it be owing to calculus in the kidney, or to malignant disease, by especial attention to the following points: — The appearance and complexion of the patient; the presence or absence of nausea on slight occasion; the presence or absence of pus and mucus in the urine mixed with blood corpuscles; and, lastly, by careful exploration of the abdomen for the detection of tumour.

In tracing out the cause for the presence of pus in the urine, a wide field is open to us. The first step in our consideration must be to exclude the constitutional condition connected with that fatal form of disease consisting in a tendency to general deposit of pus. In these cases it sometimes drains from the penis, so that a gonorrhœal taint might be supposed to exist. An instance of this kind came under my notice about two years ago, in which the symptom was rapidly followed by the deposition of pus in several parts of the body. Our next step should be to exclude gonorrhœa as a cause. This condition may perhaps be considered as sufficiently easy of detection; and this is true in most cases, when the urethra is involved; but I shall hereafter speak of other states in which the matter is not so easily determined. Now pus in the urine may come from the kidney; and it is very important that we should be able to fix on the cause of this discharge in order to form a prognosis. A discharge of pus from the kidney may proceed from

an abscess produced by any cause, and it is the history alone which can assist us to a correct diagnosis. The suppuration may have its origin in old stricture, which, producing obstruction to discharge of urine, will eventually enlarge the ureters, inflame the pelvis and urinary tubules, and produce abscess in the organ; or it may, on the other hand, have its origin primarily from the secreting structure, owing to the presence of calculous matter.

In cases of this kind the history becomes of the greatest importance, and it is sometimes not a little interesting (as connected with the ethics of our profession) to observe the advantage here enjoyed by those who make it their object to engage the confidence of their patients. There is great opportunity for the display of small wit in dealing with urinary cases, and those who indulge in it must be content to remain ignorant of many valuable points of history. If on inquiry, then, we are informed of frequent attacks of gonorrhœal inflammation, old stricture, and enlarged prostrate, we shall generally be correct in connecting the discharge of pus with abscess in the kidney, secondarily induced as above described; but if, on the other hand, no such information can be obtained, and we have an old history of hæmaturia followed by comparative immunity from symptoms, but with an eventual attack of pain in the loins, rigors, and passage of urine containing pus, we may conclude very fairly that calculous mischief is the source of

the evil. The advantage of making a correct diagnosis in this case is great, for if calculus cause the pus we may be sure our patient is a far better life than if the mischief have originated in stricture, and the consequent extension of disease to the kidney. Remedies can do much in the former case, whereas in the latter we have a complication to deal with, in which the indications for treatment are more or less antagonistic. Thus the urethra must be kept pervious, which cannot be done without sympathetically irritating the kidney, and unfortunately this indication is sometimes too perseveringly acted upon. In cases in which stricture forms the remote cause of the evil, we generally find a gradual increase in the quantity of pus. This is owing to the inflammatory action proceeding gradually, and producing pyelitis, or inflammation of the pelvis during its progress to the secreting structure, when well marked and sympathetic constitutional symptoms bring the case before the medical attendant, even if the turbid state of the urine have escaped the notice of the patient. When pus is secreted owing to the presence of calculous matter, it has been supposed that we ought to find some indication in the form of deposit from the urine. Thus, that if uric acid or oxalate of lime were producing the mischief, we ought to detect the microscopic crystals. This is a great mistake. When calculous disease has gone thus far, (and it often will do so most insidiously,)

we may often seek in vain for such indications. The inflamed membrane will scarcely permit uric acid to deposit, involving it, as it must on secretion, in an alkaline menstruum, while the presence of oxalate of lime, even were it observed, is an indication meaning little or nothing more than the occurrence of some change in the urates and other natural constituents of the urine, and should by no means be regarded as indicative of the nature of calculus present.

We have another cause for the presence of pus in urine in the existence of strumous disease of the kidney. Here our diagnosis may be assisted by noting the age of the patient, as this affection generally occurs at or before the age of puberty, and if uncomplicated may be diagnosed by the three following conditions:—1st. The strumous diathesis; 2ndly. The absence of calculous history; 3rdly. The absence of bladder disease; and I may add, 4thly, by the fact that in these cases we find the uric acid in the urine prone to decompose for the production of oxalate of lime, so that the pus corpuscles, as seen under the microscope, are intermixed with numerous octahedra.

As strumous affection of the kidney advances, especially in children, we often observe tumour of the abdomen indicating its seat, and are thus at once enabled to determine the nature of the case. The diagnosis in this stage, however, is scarcely of

much value, as we can have no hope even of arresting the progress of the disease.

When pus appears in the urine, and we fail to trace it to the conditions I have described, we must look to the state of the prostate and the bladder. The former, admitting as it does of digital examination, may sometimes be proved the source of discharge by tenderness on pressure. Suppuration in this part of the urinary apparatus is far from uncommon; and a very satisfactory mode of determining its presence consists in obtaining from the patient information as to the conditions attending erection. We shall generally learn that there is considerable pain on such occasions, and more especially so if the bladder chance to be full at the time, as happens during the wakeful hours of the morning. This suppurative action may have had its origin in the presence of calculi in the prostate, these being composed, as is well known, of phosphate of lime.

With the assistance derived from digital examination, and with a knowledge of the conditions I have described, we may generally determine whether or not the purulent discharge proceeds from the prostate. Having now excluded every urinary organ, excepting the bladder, as yielding the pus found in the urine, we have next to consider the conditions of that viscus which are capable of producing such a result.

Suppuration from the vesical mucous membrane may be produced by extension or metastasis of gonorrhœal inflammation, — by the presence of calculus, or it may occur as a result of old stricture interfering with the proper discharge of urine from the bladder. In determining which of the above conditions we may be dealing with, the history of the case is especially necessary to our diagnosis. It will merely be necessary here to allude to gonorrhœal inflammation, as simulating calculus.

The patient may try to deceive, as persons ashamed of contracting gonorrhœa sometimes will, but the absence of a stone will lead us to the most probable, if not the only explanation of the symptoms.

There is by no means necessarily a discharge from the urethra in these cases. That may have ceased, and the inflammation be entirely confined to the bladder. The pain at the end of the penis, the frequent desire to pass water, and the occasional appearance of blood with the pus, has sometimes, however, deceived the practitioner into a belief that stone must exist. The history here, if it can be obtained, is our great adjuvant.

I shall now proceed to speak of the treatment of the several forms of calculous disease which I have noticed; and first, with regard to calculus in the kidney. When this condition has

been recognised by those violent symptoms, indicative of the passage of a foreign body down the ureter, our first effort must be to produce complete relaxation and freedom from spasm. To effect this purpose the warm bath and opium are the most approved remedies. All that need be said with respect to the exhibition of the latter is, that it should be given in full dose. From forty minims to a dram of the tincture of opium, or of the sedative solution of Battley, will generally answer the purpose; and before the effects are apparent, let the patient be placed in the bath at 98° Fahr., with an attendant to watch him. If he begin to feel drowsy he may be removed, gently dried, and wrapped up warmly in bed. Do not let the patient, as is sometimes done, first take a warm bath, and then swallow the dose of opium.

Should this treatment fail in its object, it may be repeated on the patient the next day, and meanwhile demulcent drinks and aperients may be given with advantage.

The formulæ most advisable are such as will tend to render the urine alkaline as secreted by the kidney. As a demulcent, citrate of potash, given in the effervescing form every four hours, is very grateful, care being taken to make up half a dram of the salt in each draught. This renders the urine alkaline, and less irritating to the mucous surfaces. A dose of rhubarb and magnesia at night, with barley-water, and mild

fluid nourishment, are all that can be further required. When a calculus remains in the kidney, causing, as I have described, hæmaturia, and dull loin pains, then we have a chronic state to deal with, requiring constant attention. This is generally a protracted affair, and constitutional effects of a marked character sometimes appear, such as dyspeptic attacks, with tendency to nausea, and other evils.

Here the object has sometimes been to get rid of the calculus by diuretics, and under some states of system this may be of advantage. The attempt, however, is so seldom attended with success, that when it apparently succeeds, it is probable we are giving credit to our remedy for relief afforded, irrespective of its influence. Substances which readily affect the urine, and are of a balsamic nature, have been recommended by the old writers, to effect this purpose, and among them the so-called balsams of Tolu and Peru were highly prized. On the whole, it is probable we effect most by rendering the urine as little irritating as possible, and thus relieving the spasm consequent on the presence of a foreign body. In this way too we often succeed in removing hæmaturia when it sets in, and in quieting the fears of the patient which are always aroused by that symptom. The use of the neutral salts of vegetable acids, combined with sedatives, such as henbane and lettuce, are advisable here. The citrate or tartrate of potassia

in moderate dose, increasing the proportion of tartrate should the bowels become confined, may here be prescribed with marked good effect, and in all cases of this description a water may be drunk at dinner containing half a grain of citrate of potash in each pint bottle. Such a water is now prepared in London under the name of citrated water. It is bottled, and charged with carbonic acid gas, and forms a most agreeable beverage, either alone or in admixture with such alcoholic stimuli as the practitioner may think fit to prescribe. It assists the other remedies in lessening the acidity of the urine, in preventing the deposit of uric acid, if that be the source of evil, which is nearly always the case, and in relieving spasm.

The hæmorrhage caused by a calculus in the kidney may become very considerable. The patient's face may be blanched, and the pulse be frequent and irritable under its continuance. In these cases, I know nothing equal to lead as a styptic. The acetate of lead, in doses of two grains, combined with from a quarter to half a grain of opium, taken every four or six hours, if the bleeding be excessive, is most valuable; and do not be deterred from its use by constipation, nor by the fear that the gums may become permanently affected by the remedy. The former effect is easily removed by the use of castor oil at intervals; and as to the blue colouration of the gums caused by lead, it always passes off when the remedy is

disused; and it is surprising how statements to the contrary could ever have gained credit among practitioners.

When by careful use of appropriate remedies we have succeeded in keeping down hæmorrhage, and in most cases this scarcely exists to such an extent as to require styptics, our next object must be to place the patient under conditions which will prevent the calculus increasing in size, and, if possible, allow of a cyst forming over it. If this can be brought about, all trouble is at an end. There is here a double purpose to answer, and it must at once be obvious how very important it is to avoid all possible sources of irritation to the kidney.

Rest should be enjoined, or only such an amount of gentle exercise allowed as may be necessary to maintain health. The medicines exhibited should so act on the urine as to render it unirritating to the inflamed membrane. The natural amount of acidity should be lessened by the administration of the citrate or tartrate of potash, according as it may be found convenient to purge or not, and these remedies should be repeated three times during the day. Beyond this little need be done, except perhaps to add a few drops of tincture of hyoscyamus to each dose of our saline mixture. In some cases where there is much sympathetic bladder irritation it is right to have recourse to opiate suppositories at night. The great point, however, is to maintain the secreted urine of alka-

line character. I may here remark that when urine is rendered alkaline by the neutral alkaline salts containing a vegetable acid, the supercarbonate of the alkali which appears in the urine prevents a tendency to phosphatic deposit. This I observed lately in a case which I have had frequent occasion to quote, where lithotomy had been performed, and in which there was difficulty in healing the wound.

The whole surface of the opening in the perineum, through which the urine passed, was coated with earthy phosphates. Under the use of the citrate of potash, in combination with steel, this deposit rapidly disappeared.

The advantage of rendering urine alkaline when it has to pass over an inflamed mucous membrane, scarcely needs remark. Any one who has treated gonorrhœa, or suffered from the complaint, must be aware that urine of normal acidity is very irritating to an unhealthy mucous surface.

I must here make a few remarks on the best mode of preventing the formation of calculi in the kidney, and before doing so would remind the reader how little there is, excepting uric acid, to excite our fears. Any state of urine brought about by our remedies, which will prevent or interfere with the deposition of this substance, may of course be expected to prevent also the deposition of its derivative, the oxalate of lime; and so long as we can keep the mucous membrane free from

irritation (so that its alkaline liquor shall not be poured out) we may expect that the earthy phosphates will not deposit. Now all these conditions are answered by the neutral alkaline salts of vegetable acids, and though in some cases of confirmed lithiasis there is great difficulty in obviating the tendency to reformation of calculus; still I have reason to believe that very great benefit is obtained from the use of these remedies as prophylactics. With this view they had better be given in some very convenient form, and appearing as little like medicine as possible.

The plan I adopt consists in recommending a bottle of citrate of potash to be kept on the dressing table, and of this the patient is enjoined to swallow half a teaspoonful every morning in as much water as he pleases. The next dose may be taken at dinner in the form of "citrated water," already described.

In this way much may be done to interfere with the evils attending the deposit of uric acid. It may be asked, however, whether this plan is suitable for all forms of calculous deposit. I believe that inasmuch as it tends to prevent the deposit of the earthy phosphates upon a nucleus of any kind, it will be of advantage in all cases ; but we may especially regard it as a prophylactic in the uric acid and oxalate of lime diatheses. The prophylactic treatment of cystic oxide, uric oxide, carbonate of lime, and silicic acid, all of

which are but very rarely met with as constituents of calculous matter, is at present a mystery.

What I have stated with regard to the kidney when stone exists in its structure, applies forcibly to all cases of vesical calculus. Here our object should be to render the urine of an unirritating quality by means of alkaline treatment. To encourage the use of mild demulcent drinks, and at the same time to have recourse to such forms of sedative as may be best suited to the cases. In this way the amount of pus and ropy mucus (which may be regarded as altered pus) will often very sensibly decrease, and the bladder be brought to a condition in which the operation either of lithotomy or lithotrity may be performed with better prospect of success. In like manner, after those operations, the use of the neutral salts above alluded to will prove of the greatest service, and much suffering be saved the patient.

It is often desirable to ascertain whether patients with calculus in the bladder are the subjects of morbus Brightii. I have frequently been referred to in such cases, and though it is often nearly impossible to give an opinion, still we sometimes may be able to determine the point. These patients pass both pus and blood, so that the question is much complicated, for pus and blood will both produce an albuminous state of the urine. Here, as I have above described when speaking of renal calculus, &c., we must wait the result of

treatment, and try to obtain, if possible, a more healthy urine. We must examine microscopically in order to ascertain that it is free from blood and pus corpuscles, and if so we may proceed to test for albumen. Should the urine still be albuminous, it is more than probable that we have morbus Brightii complicating the calculous disease

The treatment of these cases does not fall within the limits of these lectures; but I may remark that operations performed on those who suffer from morbus Brightii are attended with great danger, and that this especially applies to the operations of lithotomy and lithotrity.

THE END.

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